d. To calculate the domain algebraically, first observe that $g(x)$ must be within the domain of f.

$1 \le g(x) \le 5$ Write $g(x)$ in the domain of f.

$1 \le x - 3 \le 5$ Substitute $x - 3$ for $g(x)$.

$4 \le x \le 8$ Add 3 to all three members of the inequality.

Next observe that x must also be in the domain of g, specifically, $2 \le x \le 7$. The domain of $f \circ g$ is the *intersection* of these two intervals. Number-line graphs (Figure 1-4i) will help you visualize the intersection.

$\therefore$ the domain of $f \circ g$ is $4 \le x \le 7$.

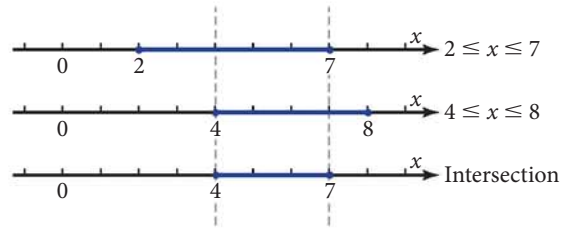


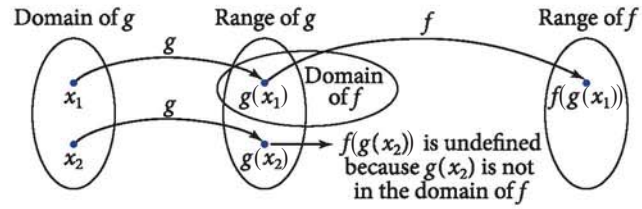
Figure 1-4i

DEFINITION AND PROPERTIES: Composite Function

The composite function $f \circ g$ (pronounced "f composition g" or "f of g") is the function

$$(f \circ g)(x) = f(g(x))$$

Function g, the inside function, is evaluated first, using x as its input. Function f, the outside function, is evaluated next, using $g(x)$ as its input (the output of function g).



The domain of $f \circ g$ is the set of all values of x in the domain of g for which $g(x)$ is in the domain of f. The figure shows this relationship.

Note: Horizontal dilations and translations are examples of composite functions because they are *inside transformations* applied to x. For instance, the horizontal translation $g(x) = 3(x - 2)$ is actually a composite function with the inside function $f(x) = x - 2$.